

What is Claimed is:

1. A valve actuating apparatus for control of fluid flow, including:

a housing having a valve body with a first port and a second port;

a toggle valve assembly including an armature at least one sealing surface connected to the armature, and a spring biasing the armature to a first position where the sealing surface closes the first port; and

a solenoid assembly including an electromagnetic coil and a pole piece having a first leg and a second leg, the first leg being shorter than the second, the first leg and the armature defining an air gap when the armature is in the first position, and the electromagnetic coil creating a magnetic field in the pole piece when electrically energized to attract the armature toward the first leg to a second position wherein the air gap is reduced.

2. The valve actuating apparatus as set forth in claim 1, wherein when the armature is in the second position, the armature is in contact with the first leg of the pole portion.

3. The valve actuating apparatus as set forth in claim 1, wherein the second leg includes a pivot area on the bottom that the armature pivots about and sloping surfaces extending from the pivot area, and the toggle valve assembly includes a second sealing surface that closes the second port when the armature is in the second position.

4. The valve actuating apparatus as set forth in claim 3, including a proportional control allowing proportional fluid flow through the ports, and the first sealing surface moves away from and opens the first port when the armature moves to the second position.

5. The valve actuating apparatus as set forth in claim 1, further including a common port in communication with the second port when the armature is in the first position and in communication with the first port when the armature is in the second position.

6. The valve actuating apparatus as set forth in claim 1, wherein the armature is at least partially enclosed in an encapsulation medium.

7. The valve actuating apparatus as set forth in claim 6, wherein the encapsulation medium includes a pair of integrally formed poppets.

8. The valve actuating apparatus as set forth in claim 7, wherein one of the poppets is longer than the other, and the longer poppet closes the first port when the armature is in the first position.

9. The valve actuating apparatus as set forth in claim 8, further including a diaphragm mounted to the poppets, and the diaphragm forms the sealing surface.

10. The valve actuating apparatus as set forth in claim 6, wherein the spring is at least partially encased by the encapsulation medium.

11. The valve actuating apparatus as set forth in claim 1, wherein the spring includes a pair of torsional force legs.

12. The valve actuating apparatus as set forth in claim 11, wherein the spring includes a frame extending from the torsional force legs for mounting the spring to the housing, and the armature pivots about a pivot area on the second leg.

13. A valve actuating apparatus for control of fluid flow, including:

a housing having a valve body with a first port and a second port;

a toggle valve assembly including an armature, a first and second poppets connected to and extending from the armature, the first poppet being longer than the second poppet, and a spring biasing the armature to a first position such that the first poppet closes the first port; and

a solenoid assembly including an electromagnetic coil and a pole piece, the electromagnetic coil creating a magnetic field in the pole piece when electrically energized to attract the armature to a second position wherein the first port is open and the second port is closed.

14. The valve actuating apparatus as set forth in claim 13, wherein the second poppet closes the second port in the second position.

15. The valve actuating apparatus as set forth in claim 13, further including a common port in communication with the second port when the armature is in the first position and in communication with the first port when the armature is in the second position.

16. The valve actuating apparatus as set forth in claim 13, wherein the armature is at least partially enclosed in an encapsulation medium, and the poppets are formed in the encapsulation medium.

17. The valve actuating apparatus as set forth in claim 13, further including a diaphragm mounted to at least one of the poppets to provide sealing surfaces against valve seats on the ports.

18. The valve actuating apparatus as set forth in claim 16, wherein the spring includes torsional force legs and at least a portion of the spring is encased by the encapsulation medium.

19. The valve actuating apparatus as set forth in claim 18, wherein the spring includes a frame extending from the torsional force legs for securing the spring to the housing.

20. The valve actuating apparatus as set forth in claim 13, wherein the pole piece includes a first leg and a second leg, the first leg being shorter than the second leg.

21. The valve actuating apparatus as set forth in claim 20, wherein the armature and the first leg of the pole piece define an air gap when the armature is in the first position, and the air gap is reduced when the coil is energized.

22. A valve actuating apparatus for control of fluid flow, including:

a housing having a valve body with a first port and a second port;

a toggle valve assembly including an armature, a spring having legs extending outwardly from the armature and an encapsulation medium enclosing at

least a portion of the armature and the spring, the spring providing a torsional force to bias the armature to a first position wherein the first port is closed; and

a solenoid assembly including an electromagnetic coil and a pole piece, the electromagnetic coil creating a magnetic field in the pole piece when electrically energized to attract the armature to a second position in which the first port is open.

23. The valve actuating apparatus as set forth in claim 22, wherein the encapsulation medium includes a pair of integrally formed poppets, the first poppet being longer than the second poppet.

24. The valve actuating apparatus as set forth in claim 23, including proportional control to allow proportional fluid flow through the parts and wherein the first poppet closes the first port in the first position.

25. The valve actuating apparatus as set forth in claim 24, further including a diaphragm mounted to at least one of the poppets to provide a sealing surface against a valve seat of one of the ports.

26. The valve actuating apparatus as set forth in claim 22, wherein the spring is made of metal and includes a frame to secure the spring to the housing.

27. The valve actuating apparatus as set forth in claim 22, wherein the pole piece includes a first leg and a second leg, the first leg being shorter than the second.

28. The valve actuating apparatus as set forth in claim 27, wherein the armature and the first leg define an air gap when the armature is in the first position.

29. The valve actuating apparatus as set forth in claim 28, wherein the air gap is reduced when the armature moves to the second position as the coil is energized.

30. A valve actuating apparatus for controlling fluid flow, including:

a housing including a valve body having a first port and a second port;

a toggle valve assembly including an armature, the armature being moveable between a first position and a second position, wherein when the armature is in the first position, the first port is closed, and when the armature is in the second position, the first port is open;

a solenoid assembly including an electromagnetic coil and a pole piece, the pole piece including a central portion located inside the coil and a pair of legs extending from the central portion, one of the legs being shorter than the other, the armature contacting only one of the legs while in the first position and contacting both of the legs while in the second position.

31. The valve actuating apparatus as set forth in claim 30, wherein the one leg that the armature contacts in the first position includes a pivot area that the armature pivots about and sloping surfaces extending away from the pivot area.

32. The valve actuating apparatus as set forth in claim 31, wherein the shorter leg of the pole piece has a sloping bottom surface at the same inclination as one of the sloping surfaces extending from the pivot area.

33. The valve actuating apparatus as set forth in claim 30, further including proportional control with a variable magnetic force between the pole piece and the armature to provide proportional fluid flow through the ports.